

Unit Six

Wetland Habitats

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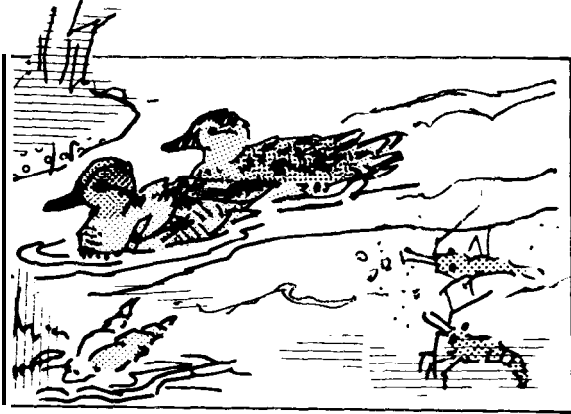
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Alaska is more than 85 percent wetlands. Look at the number of ponds, rivers, sloughs, streams, lakes, and freshwater marshes on a detailed map of the state--not to mention the 34,640 miles of coast-line with its estuaries, salt marshes, tidelands, river deltas, and barrier island lagoon systems.

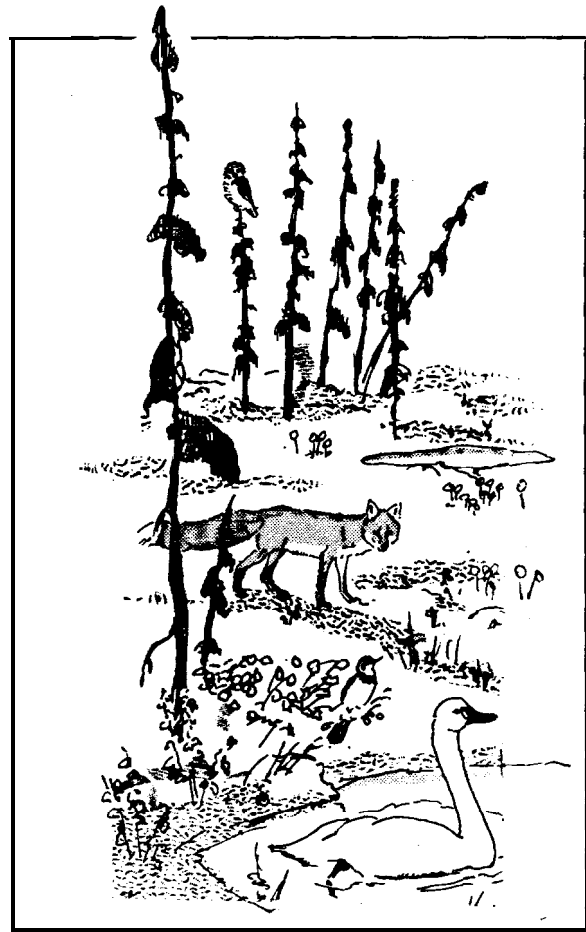
Wetlands are highly productive biologically, producing more biomass per acre than our best farm fields. Alaska's wetlands provide food, water, and cover for fish and wildlife, and food and recreation for people. Alaskans visit wetlands to pick berries or to fish, to hunt moose, bears, ducks, and

geese, to trap muskrat and beavers, and simply to watch and enjoy the wildlife. Wetlands function in other ways useful to humans: they help control floods, buffer storms, improve water quality, and provide drinking water.

In Unit 11, we'll discuss the ways in which wetlands benefit us. For now, let's take a closer look at what a wetland is.



Alaska's wetlands are wet most of the summer and support plants and animals that prefer wet soil. In this book we talk about four categories of wetlands: coastal wetlands; wet tundra; rivers, lakes, and marshes; and muskeg. (These divisions basically follow the classification system used in the Alaska Department of Fish and Game's Wildlife Week materials by Sue Quinlan--see bibliography. We have used the Water, Wetlands, and Wildlife volume of the Wildlife Week program extensively in preparing this unit.)



These four types of wetlands are tied together by the water cycle. Water falls on land as rain and snow, then heads slowly toward the sea. Some water collects in low-lying areas, where it creates lakes, ponds, puddles, and soggy land. The rest flows in rivers to the sea; surface sea water evaporates and collects in clouds; clouds blow inland; and the water falls again as rain or snow.

Worksheet 6A

What Makes a Habitat?

The concept of habitat is very important. Plants and animals need their habitat (or home) to provide the right amount of food, water, and safe cover. The single greatest threat to wildlife is loss of habitat. As towns, roads, and industrial developments spread, the ranges of animals like caribou, bears, and waterfowl are reduced dramatically. Some species are able to co-exist with people; others cannot adapt to human encroachment. Mallards will return to a lake that is being built up. Trumpeter swans, by contrast, although they may tolerate some human activity, will not nest on a lake that is being crisscrossed by motorboats.

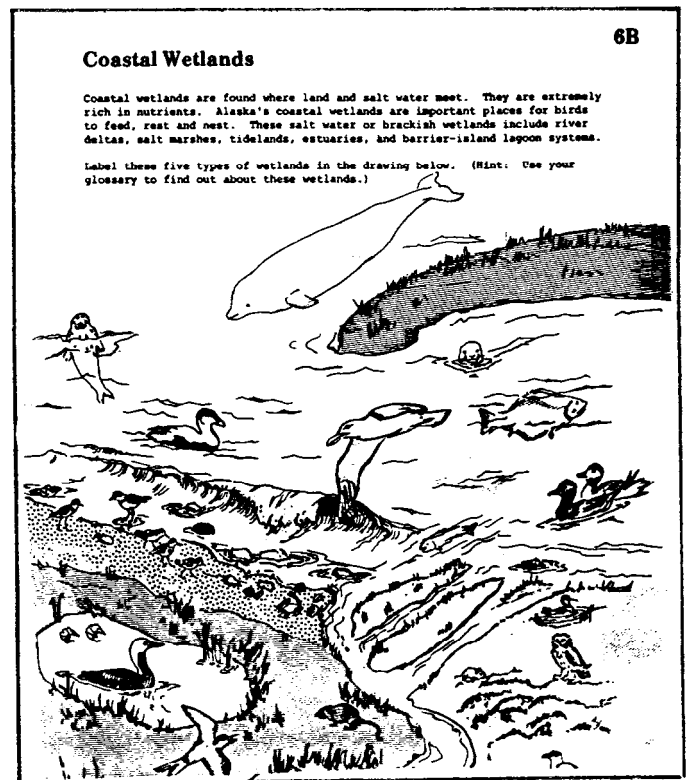
Birds nest in many different kinds of habitat, but the summer nesting birds in Alaska concentrate in the wetlands; the river flats and tundra. Millions of migratory birds nest and raise their young in Alaska, primarily in these biologically rich wetland areas. If too much of this key habitat is destroyed, they will have no place to go.

For designing a wetland logo, students will need colored pencils, crayons, or narrow felt-tip pens, scissors, cardboard, glue and safety pins. Students may want to sketch their logos in their books, then draw them again on a separate piece of paper. After coloring, they can cut the logos out, paste onto cardboard, attach safety pins, perhaps glue on ribbons, and wear as badges.

Worksheet 6B

Coastal Wetlands

Alaska's coastal wetlands, where nutrient-laden river water meets the salt water, are biologically among the most productive areas in the world. They are important feeding, resting, and nesting habitat for astonishing numbers of migratory birds. Coastal wetlands take different forms: river deltas, salt marshes, tidelands, estuaries, and barrier island lagoon systems. Every small delta and salt marsh is an important link in the chain of wetlands that enables birds to migrate from as far away as South America and Polynesia to arctic Alaska. Most migratory waterbirds--from swans to sandpipers--stop in wetlands to rest and eat in preparation for the next leg of their journey. They also need wetlands all along their route for shelter during storms.



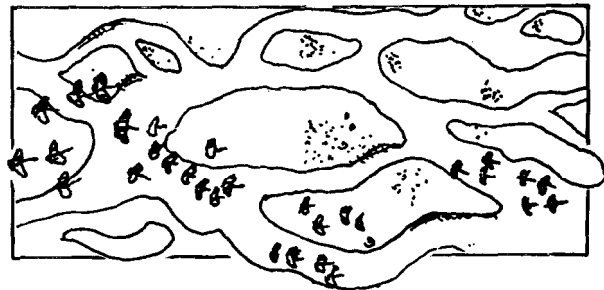
DELTA

Migratory birds are found in all of Alaska's coastal wetlands, but certain areas are particularly important to large numbers of birds. For example, the delta at the mouth of the Stikine River in southeast Alaska is a migration stopover for thousands of snow geese, trumpeter swans, ducks, and shorebirds (or waders). Other major coastal wetlands in the state include the Copper River Delta, the Yukon-Kuskokwim Delta, Izembek Lagoon, and the North Slope's barrier island lagoon system.

The Copper River Delta in southcentral Alaska is a stopover and feeding ground for thousands of sandhill cranes and nearly 20 million shorebirds, including the entire world population of western sandpipers and most of the red knots and dunlin in North America. These birds rest and feed in the delta before flying farther north and west to nest in other Alaskan wetlands. They use their long bills to probe deep in the estuary mud for tiny clams, worms, and other invertebrates. The Copper River Delta includes not only extensive mud tidelands used by shorebirds, but also salt marshes and a series of sloughs among the freshwater ponds and marshes heavily used by ducks, geese, and trumpeter swans. Offshore sandbar islands provide nesting habitat for glaucous-winged gulls, and a protected lagoon system used by salmon, seals, and sea otters.

In western Alaska, the Yukon-Kuskokwim Delta area, where wet tundra on the inland delta intergrades with rich coastal estuaries, is one of world's most important bird nesting areas. This delta alone is the nesting ground for

nearly two million waterfowl and an estimated 100 million shorebirds, including most of the western sandpipers, dunlin, and black turnstones in North America. It is important habitat for sandhill cranes, tundra swans, and three of Alaska's most beautiful ducks: the common, spectacled, and Steller's eiders. Nearly the entire world population of emperor geese and cackling Canada geese, and most of the Pacific flyway white-fronted geese and brant, nest in this area. Unfortunately, these goose populations have declined dramatically in the past few years. Biologists and interested people living all along the flyway have been joining forces to help protect them.



BARRIER ISLAND LAGOON SYSTEMS

Along the North Slope and in a few places in western and southwestern Alaska, long, narrow gravel barrier islands separate the sea from the mainland. The islands protect the lagoons from icy winds, rough seas, and the harsh scouring of pack ice. The lagoons are rich, like other coastal wetlands, because of the continuous deposit of silt and detritus (dead organic matter) by rivers and streams. The lagoon water warms up more quickly than open sea water, and the barrier islands provide nesting sites free from predators such as arctic foxes, which can't cross the lagoon waters. Molting waterfowl utilize the protected waters; Simpson Lagoon in northern Alaska is

crowded each summer with over 100,000 molting oldsquaw ducks.

The protected lagoons are important stopover places for migratory birds such as common eiders, arctic terns, and brant. Most of the western North American population of brant stop to rest in Izembek Lagoon on the Alaska Peninsula, and to feed on the eelgrass in the shallow water, before making their two-and-one-half-day nonstop flight to Baja California. Most of the world population of Steller's eiders and emperor geese also gather in Izembek Lagoon during fall, and remain in Alaska throughout the winter.

Invertebrates that live in lagoon mud are also food for fish and gray whales. Many fish overwinter in lagoon channels where a bit of open water remains during winter. Belukha whales, and ringed and spotted seals, spend much of every summer preying on fish that live in the lagoons.

The barrier islands off the Copper River Delta are sandbar islands. This barrier island lagoon system is very rich and productive, supporting large populations of fish, shellfish, marine mammals and birds. The islands are important nesting areas for thousands of glaucous-winged gulls. Most dusky Canada geese (a subspecies of Canada) nest on the Copper River Delta. But some of these duskies are starting to nest on the islands as the predator population, consisting primarily of brown bears, increases on the mainland.

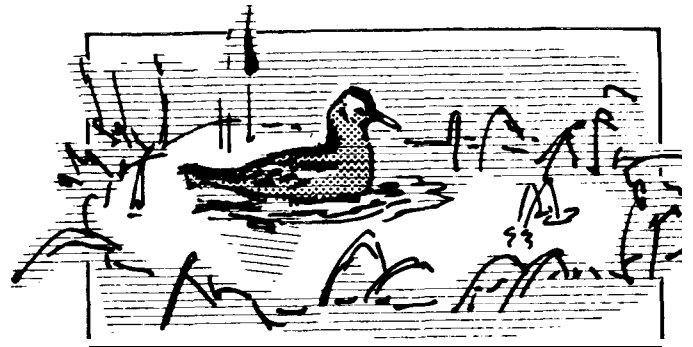
(The above material is drawn largely from Sue Quinlan's description in Water, Wetlands, and Wildlife, p. 9; Unit 2 of Wildlife Week.)

Worksheet 6C

Estuary: A Very Special Place

Estuaries, a type of coastal wetland, form where rivers meet the sea. The term includes the mouth of the river or stream, along with the bay and adjacent marshes, tideland, and river delta. Salt water and fresh water mix in warm shallow water and support an extremely high level of productivity. Scientists call this a "nutrient trap." The lighter, fresh river water flows over the heavier ocean water. The salt water moving in from below creates a circular motion that traps the nutrients. Twice a day, the rising tide from the ocean sends these nutrients surging over the marsh. And the ebb tide returns nutrients to the bay.

Nutrient-rich water draining into coastal wetlands enriches sea water and provides a rich nursery ground for marine fish and invertebrates. Clams, crabs, and abalone are among the great variety of marine animals that use estuaries during part of their lives. Most of the animal species that we harvest from the sea in Alaska depend on estuaries.



Estuary: A Very Special Place

Directions: Fill in the blanks with these words: fish, nurseries, productive, coastal wetland, plankton, fertilize, sea, fresh water, salt marshes, tidelands. (Hint: check to see whether the sentence needs a noun, verb, or modifier.)

Estuaries are very special places. Estuaries are one kind of coastal wetland. An estuary is where a river or stream meets the sea. Estuaries include bays, river, and inlets and the surrounding salt marshes and tidelands. Estuaries are extremely rich and productive places. Salt water and freshwater mix in warm, shallow areas. Nutrients from the river and the sea are blended together. This is just right for growing a thick plankton soup. Plants and animals grow in enormous quantities. Many waterfowl, mammals, and fish use estuaries as nurseries for their young. And the tide carries nutrients and detritus (dead plant and animal matter) out to sea to fertilize offshore waters. So deepwater fish benefit from estuaries, too.

answers below will vary.

1. What is the name of the estuary nearest to your community?

2. How many miles is it from your village or town to the estuary?

3. Why is the estuary important to you?



**Worksheet 6D
Wet Tundra**

Wet tundra is found over most of northern and western Alaska. Some of the areas covered by wet tundra receive only 8 to 10 inches of rain and snow per year--desert conditions. But in spite of the low precipitation, these areas are classified as wetlands because of the permafrost--permanently frozen ground--beneath the surface. Water can't soak into permafrost, so when the few inches of winter snow melts, the water remains at the surface and covers the tundra with a sheet of water.

Wet Tundra

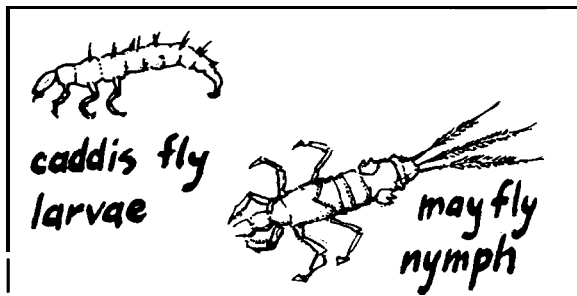
Wet tundra is found in northern and western Alaska and in some mountain valleys. Wet tundra is a flat wetland that is very important for birds. Millions of birds nest and raise their young on wet tundra. Caribou, arctic fox, wolves, arctic hares, and lemmings also live on the wet tundra.

Draw arrows showing what eats what in the drawing below. This is called a food chain. Animals that eat plants are called herbivores. Color the herbivores green. Animals that eat other animals are called carnivores. Color the carnivores blue. Animals that eat both plants and animals are called omnivores. Color the omnivores orange. (Hint: You may need to talk to an elder or a biologist, or look in a book to find out what these animals eat.)



In winter, there is not much wildlife on the tundra. Caribou paw out craters in the snow to reach lichens, sedges, and shrubby plants that are buried beneath wind-drifted snow. Lemmings and voles tunnel beneath the snow and also eat the previous summer's plant growth -- grasses, sedges, willows, and mosses. Ptarmigan, tundra hares, and beaver also over-winter, as well as predators including wolves, foxes, weasels, ravens, and gyrfalcons.

In summer, however, the wet tundra areas teem with life. Cotton-grass and other sedges, berry plants, and other tundra plants grow quickly during the 24-hour daylight of the arctic summer. Insects, including blackflies, mosquitoes, and springtails, flourish, using the ample ponds and puddles for their larval stages.



These insects are the prime source of protein for the millions of migratory birds that raise their young on the tundra. Alaska's wet tundra areas are important nesting grounds for brant, Canada and greater white-fronted geese, three types of eiders, oldsquaw, and other ducks. During years of drought, even more ducks, millions of them that usually nest in Canada, come north to Alaska's wetlands. Without our wetlands, these birds could not survive dry summers.



Wet tundra is critical habitat for many waders, such as western and semipalmated sandpipers, phalaropes, dunlins, and whimbrels. These birds lay eggs and raise their young in just two short months.

Other nesting birds on wet tundra include swans, loons, parasitic jaegers, snowy owls, and short-eared owls.

Wet tundra is also crucial for thousands of geese after the nesting season. Brant, Canada geese, and greater white-fronted geese migrate to large wet tundra lakes to molt their wing feathers. During the few weeks they are unable to fly, the geese feed on the rich sedge meadows and escape predators by swimming offshore in the lakes.

(The above description was adapted from Sue Quinlan's Water, Wetlands, and Wildlife, p. 6.)

Worksheet 6E

Rivers, Lakes, and Marshes

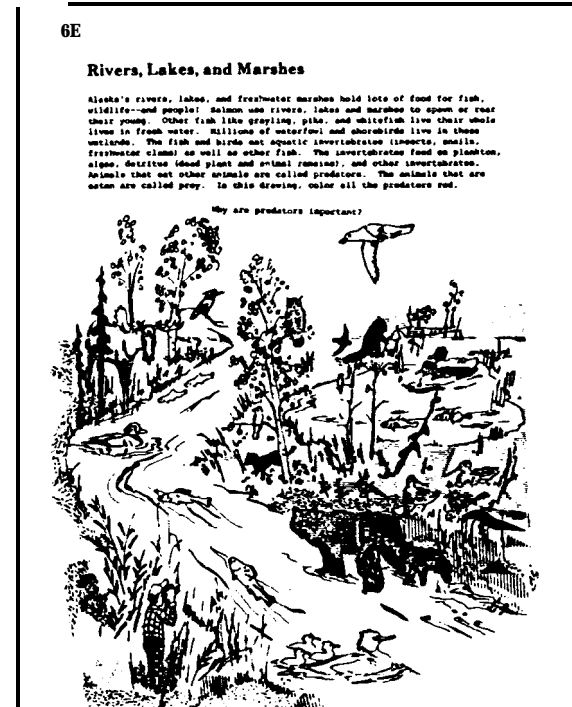
Water from Alaska's vast expanses of muskeg and wet tundra seeps and flows into low-lying areas to form rivers and lakes. Freshwater marshes form along the riverbanks and lake shores. Detritus from these marshes provides nutrients for the plants and animals that live in the rivers and lakes.

This detritus is eaten by aquatic invertebrates such as snails, clams, and the larvae of mayflies, stoneflies, blackflies, and caddisflies; They are also eaten by some fish, such as rainbow trout and Dolly Varden. Young silver salmon feed on detritus, algae, and plankton. Other kinds of fish, such as red, pink, and king salmon fry, feed on detritus-eating animals. Since most salmon fry spend one to three years in fresh water before migrating out to sea, their survival depends on detritus in our streams.

Other wildlife that depend on this aquatic food chain include river otters, mink, brown bears, water shrews, spotted sandpipers, yellowlegs, bald eagles; ospreys, and kingfishers. Although these animals live mainly on land, they need the food resources of rivers and lakes in order to survive.

Algae are the most common lake and river plants. Pondweeds are found in the slower sections of rivers, throughout ponds, and along the shallower portions of lakes. Marshes are characterized by soft-stemmed plants: grasses, sedges,

and rushes. Cattails are common in Interior Alaska. Beavers create a lot of marsh habitat as they dam up streams and sloughs.



Rivers, lakes, and the surrounding marshes have been used as important sources of food throughout human history. Villages are traditionally located along river banks or lake shores. Today, as they always have been, rivers and lakes are vital avenues of transportation, for boats and floatplanes in the summer, and for dog teams, snowmobiles, and ski-planes in the winter. Commercial, sport, and subsistence fishing depends on the salmon runs up Alaska's network of mighty rivers and lakes. These wetland areas support a tourist industry as well; people travel from all over the world to photograph, fish, hunt, and observe wildlife.

(This description is based on Sue Quinlan's Water, Wetlands, and Wildlife, p. 9.)

Worksheet 6F

Muskeg

Muskeg is another word for bog. It is a type of freshwater wetland that occurs below tree line on low-lying lands in Alaska. Lakes and ponds are scattered throughout the muskeg.

Common muskeg plants include sphagnum moss, blueberries, cranberries, willows, Labrador tea, sundews, dwarf birch, and small trees like black spruce in Interior Alaska, mountain hemlock in south-coastal Alaska, and lodgepole pine in southeast Alaska--all plants that thrive in areas where the ground is covered or filled with water. The muskeg ground is composed of a thick layer of peat (decayed plants, primarily sphagnum moss), which in some places may be 40 or more feet thick. Peat soaks up water, so walking on muskeg in summer has a spongy quality.

Millions of ducks, especially northern pintails, American wigeon, lesser scaup, surf scoters, and white-winged scoters nest in and near the muskeg of the Yukon Flats, Minto Flats, and Tetlin. These areas are among the most important duck-breeding areas in North America. During years when the prairie potholes are dry; even more ducks than usual arrive from Canada and the northcentral United States.

Many Canada and greater white-fronted geese, as well as loons, grebes, and mergansers make their nests on muskeg lakes. Sandhill cranes dance their courtship displays and raise their young on

6F

Muskeg

One sign of a muskeg or bog is lots of sphagnum moss. As the sphagnum moss dies and decays, it turns into peat. This peat is sometimes 40 or more feet thick! Walking on a muskeg in summer is like walking on a great big sponge. You sink in and the ground goes "squish." Common muskeg plants are sphagnum moss, blueberries, cranberries, willow, sundew, sedge, Labrador tea and small trees like black spruce. Small ponds, puddles, and lakes are common in muskeg. The water is often acidic. As in most habitats, birds and animals tend to blend in with their surroundings. We say they are camouflaged. Color this drawing so that the birds are camouflaged.



muskeg wetlands, too.

Muskeg wetlands provide habitat for black bears, moose, muskrat, mink, beaver, red fox, marten, wolves, coyotes, and deer. People go to these areas to pick berries, fish, hunt, trap, and to observe and photograph wildlife.

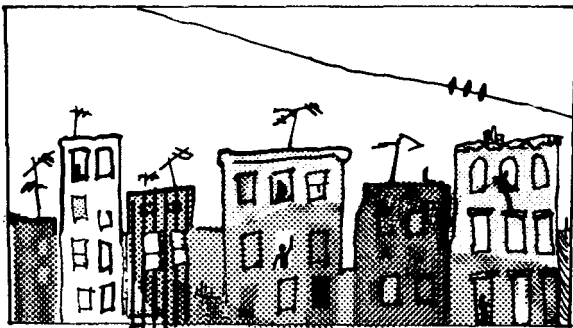
(Again this description is based on Sue Quinlan's Water, Wetlands, and Wildlife, p. 6.)

Worksheet 6G

Other Bird Habitats

Birds are found everywhere. Discuss with students the fact that different birds prefer different habitats--just like people. Some people like Interior Alaska best, other people like coastal Alaska, and others like the lower 48 states, Hawaii, or foreign countries. Similarly, some birds live deep in the forest, others are found only high in the mountain tundra, and others live on cliffs. Although we have emphasized wetlands habitat in this book, both because wet lands make up the bulk of Alaska and because wildlife tends to be heavily concentrated in wetlands, students who want to look for woodpeckers will have to look in the woods, and those who want to see wheatears will have to go up into the dry mountain tundra where wheatears build their nests.










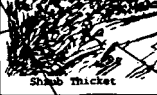


Wildlife tends to be most abundant on the border between two types of habitat--where the forest touches the edge of a marsh, for example. At the junction you will find birds and animals from both types of habitat. This is known as the "edge effect," and is a good concept to introduce to students.

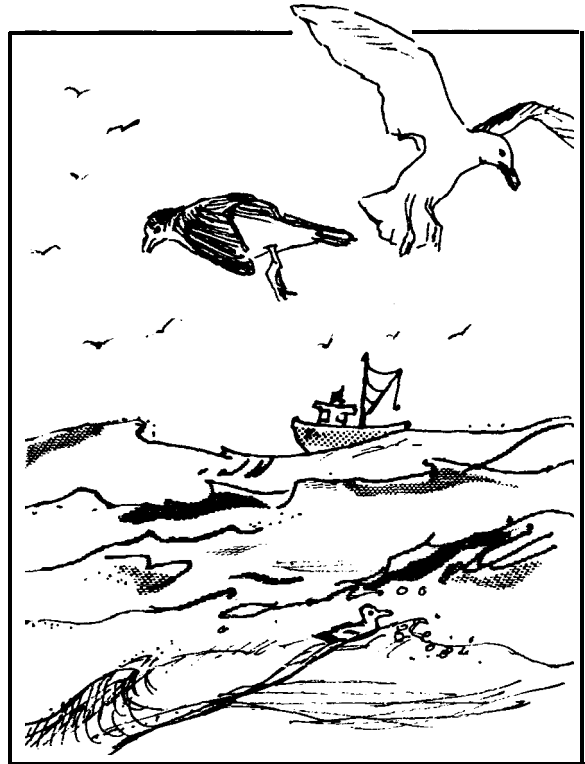


6G

Other Bird Habitats

In addition to wetlands, there are other kinds of bird habitats in Alaska. Match the pictures of these habitats with their descriptions--and with the birds that live in them (color matched sets, or cut out and paste, or connect with lines).

<p>Alder and willow are found along rivers and creeks. Birch-elder-willow thickets are found in mountain areas.</p>		 <p>Rain Forest</p>
	 <p>Cliffs and Rocky Areas</p>	<p>Some seabirds and diving ducks spend all their life at sea. They just come ashore to nest.</p>
 <p>Man-made Areas</p>		<p>White spruce, birch, aspen and spruce-fir trees--mixed with alder and willow bushes--are found in Interior Alaska. They provide some sites and food for a great variety of birds.</p>
	<p>Rocky islands and cliffs along the shoreline provide safe nesting sites for seabirds and shelter for sea mammals.</p>	 <p>Ocean</p>
	 <p>Shrub thicket</p>	<p>White spruce and the great trees of this coastal forest. Sometimes they grow more than 200 feet high--hullocks, alders, poplars and hemlock also grow among the white spruce.</p>
 <p>Spruce-Hardwood Forest</p>	<p>People built roads, homes, schools and stores to make this habitat.</p>	



Worksheet 6H Habitat Choice

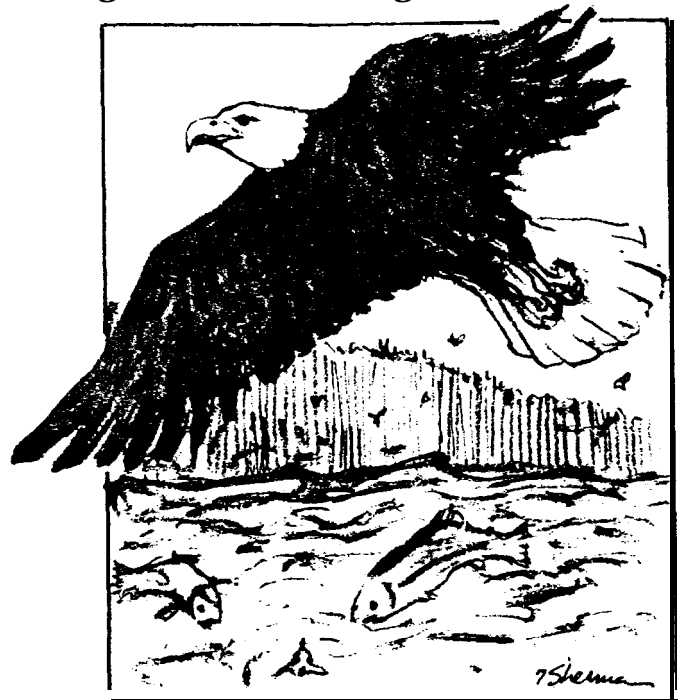
This activity provides students a chance to do some writing on their own, and to review what is covered in this unit.

Additional Activities:

1. **Art, Science, Language Arts:** Divide class into small groups to investigate wetland habitat types. Make murals of local wetland types, labeling cover (shelter or nesting site), food and water. Use string to connect the food with the organisms that eat it. Draw the sun, which provides energy to plants.
2. **Language Arts, Science:** Draw a chart on the board comparing two different wetlands--wet tundra vs. muskeg; estuary vs. freshwater marsh; and so on.
3. **Physical Education, Science:** Eagles eat fish, and fish eat insects. Let students choose to be insects, fish, or eagles. On a signal from the teacher, the eagles try to tag the fish, while the fish try to tag the insects. If an eagle catches a fish, the fish turns into another eagle, and if the fish catches an insect, the insect turns into a fish. After a few moments, stop the play. Any of the original eagles who have not caught a fish die and fall into the stream, where they are eaten

by the insects; in the next round of play, they turn into insects. Start game up again.

What happened? If you started with lots of eagles, were they all able to get enough food? Have the students reassign themselves in a way that will result in having some of each creature at the end of the game. They should discover that there needs to be a lot of insects, some fish, and a very few eagles. Not only do the eagles need the fish, but the fish also need the eagles. If there weren't any eagles to control the fish population, the fish would wipe out their food source (the insects), and starve. Similarly, without fish to keep their numbers in check, the insects would overpopulate and wipe out all the plants that make up their food source. Discuss how this game reflects the situation in the real world. What are the game's shortcomings?



4. **Language Arts, Art, Science:** Have students each choose a bird they would like to have live in their area. Have them list the habitat needs of that bird (refer to student bird guide). From this list have them write an ad for the newspaper or make a poster advertising their neighborhood or village as a prime site for a home-hunting bird.

5. **Physical Education, Science:** You'll need blindfolds, chalkboard, chalk, string, a sign that says "predator," and a sign that says "prey." Ask the class to name some regional predators and their prey. Write these pairs on the blackboard. Have two volunteers play the role of one of these pairs. Each person must wear the appropriate predator or prey sign. Clear a large space in the middle of the room. Blindfold the student who is acting as prey and place her some distance from the predator. Have the predator try to approach its prey stealthily. If the prey senses the approaching predator, she should point in his direction. If the predator is thus "spotted," the game ends and a new pair is chosen. A variation of this game would be to place the blindfold on the predator, spin her around, and tell her to locate the rabbit (hare) who must remain in place (al though she may make squeaky, scratchy rabbit (hare) noises if she wishes.)

A particularly rousing and uproarious version of the game follows: clear a large space in the middle of the room.

Have the students form a large circle. In the middle of the circle place a blindfolded predator and a blindfolded prey. Gently spin each around. The predator will then begin to stalk the prey. The predator must occasionally make hungry noises (growls and lip smacking) and the prey must also make appropriate animal noises from time to time. These auditory cues will help them alternatively approach and avoid each other. After four or five pairs of students have played the predator-prey game, interest will be high for a class discussion concerning the qualities of successful predators (especially quick reflexes, good hearing and smell, overall physical strength). Also discuss ways in which prey protect themselves (speed, immobility, protective coloration, offensive odors). (Described by Barb Tervo, Selawik Elementary School, Selawik.)

6. **Language Arts:** Have students try to find as many names as possible for wetland habitats and define these names. Their list should include:

Freshwater wetlands - -marsh, swamp, bog, muskeg, pond, lake, river, stream, creek, brook, island, mudflat, point, peninsula.

Saltwater wetland- -tideland, reef, island, cove, inlet, bay, point, estuary, salt marsh, peninsula, lagoon, slough.

Unit Eight

Wetland Plants and Animals

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Wetland plants and animals thrive in wet conditions. They have made various adaptations to their aquatic environments. Water plants, for instance, often have large air spaces in their stems and leaves to help keep them afloat. Cattails have seeds that float until they reach a proper place to germinate. Certain kinds of muskeg plants eat insects to make up for the nutrient-poor soils in which they grow. Many insects spend their immature phase in the water, then fly around wetlands

during their adult life. Water striders scoot along on the surface of the water, taking advantage of the surface tension. Water boatmen and predacious diving beetles capture an air bubble to take with them when they dive below the water's surface. Amphibians, birds, and mammals have webbed feet to help them swim, and long legs to help them wade. More information on these and other adaptations can be found in Dr. William A. Niering's The Life of the Marsh (see bibliography).

Worksheet 8A Wetland Crossword

Ask the students about their own experiences with wetland plants and animals; encourage them to find out more. You might ask them to make up their own wetland puzzles, or to add onto this one.

8A
Wetland Crossword

Alaska's wetlands provide habitat for plants that prefer wet soil. Wetland animals depend on these plants for food and cover. Complete this crossword. Hint: check the pictures.

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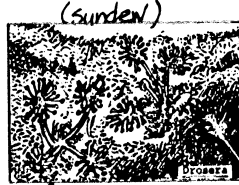
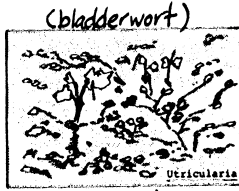
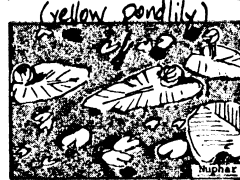
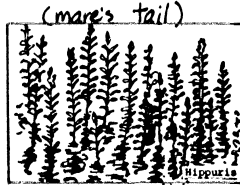
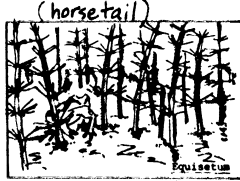
Worksheet 8B Wetland Plants Game

This activity introduces students to 24 of the most common wetland plants. Sedges, grasses, and willows of one variety or another will be found in every wetland habitat. In contrast, black spruce grows only in muskeg areas; cattail only in marshes. Students may also want to interview knowledgeable long-time residents or biologists about different uses for plants. Three good references are the Alaska Cooperative Extension Service's Wild Edible and Poisonous Plants of Alaska; Furlong and Pill's Edible? Incredible! Pondlife; and Hulten's Flora of Alaska and Neighboring Territories (see bibliography). Remind students that before they eat any plant they must be sure they know what it is. Water hemlock is a common and extremely poisonous wetland plant. There are several species of it.

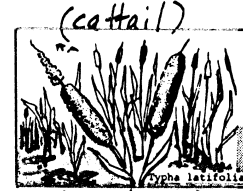
Students may be interested to learn that the parts of sedges, grasses, and reeds that are edible by humans are the roots, the tender young leaves and stems, and the dried seeds. The roots can be eaten raw, roasted or boiled. The young leaves and stems can be eaten raw in salads or cooked. The dried seeds can be cooked as cereal or made into flour.

Directions: Color, cut out and make up a game using these flash cards.

Wetland Plants Game



Wetland Plants Game



Wetland Plants Game

Many plants have adapted to wetland life.

HORSETAIL

Many millions of years ago, in the time of the dinosaurs, horsetails were the size of trees. Instead of regular seeds, horsetails have spores that come out of a fruiting body. Tap them, and the spores will come out like a soft green powder in your hand. Geese and swans enjoy eating horsetails in late summer and fall.



PONDWEED

Many types of pondweeds grow in lakes and ponds throughout Alaska. Pondweed provides cover for fish, snails and other animals. Ducks and swans depend heavily on these plants for food.



YELLOW PONDILLY

Yellow pondlilies grow from thick branching rootstocks. Many small aquatic animals lay their eggs on its leaves and stems. Moose eat the whole plant.



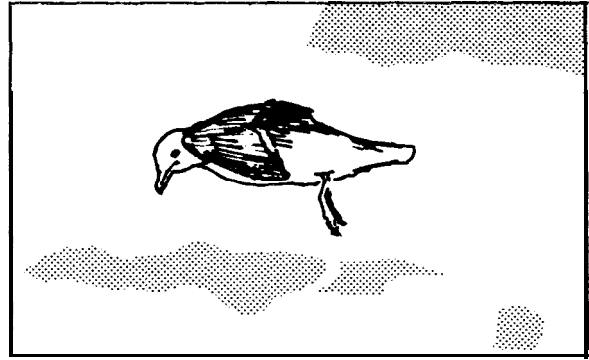
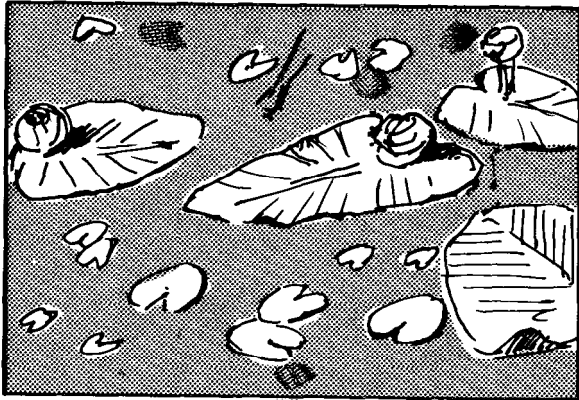
SPHAGNUM MOSS

Sphagnum, or peat mosses grow in thick greenish mats. Their leaves contain many empty cells which fill up with water like a sponge. During dry weather, the water is released slowly so the moss is always moist.



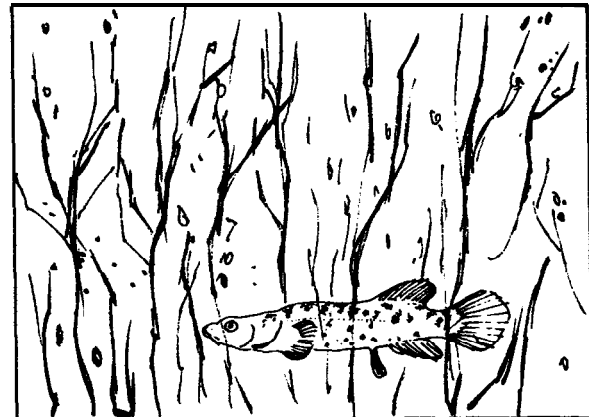
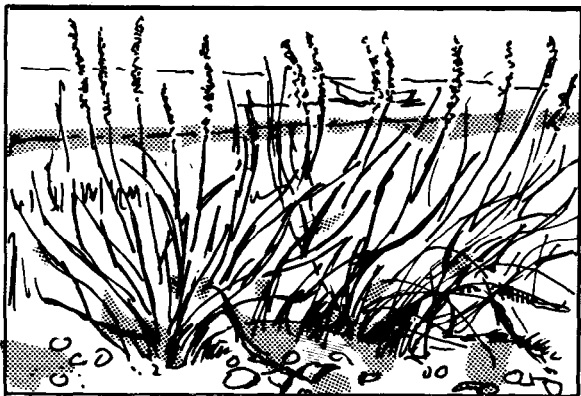
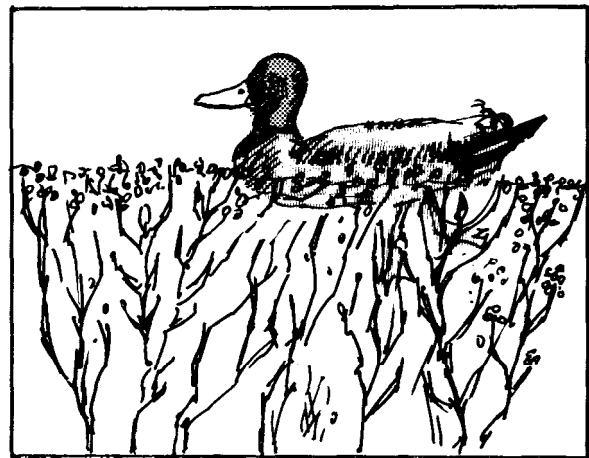
Wetland Plants Game





Additional Activities:

1. **Science, Art :** Have students **find and cut out pictures of birds and appropriate foods for these birds.** Display pictures on a bulletin board.
2. **Art, Language Arts, Science:** **Make a wetlands animal book.** Have students pair up to write reports and draw pictures of different animals that live in wetlands. Then photograph the students' faces, and arrange the pictures alongside the appropriate reports. Place in a three-ring binder and share with the community. (Suggested by Dawn Madera, Aniak School, Aniak.)



Unit Nine

Wetlands Field Trip

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Worksheet 9B - Field Notes	47
Worksheet 9C -Wetlands Checklist	50

The field trip (or trips) should be the highlight of your birds and wetlands study. Chances are, your students will have plenty of interesting experiences: watching a honking goose fly overhead, a moose wading as it feeds on water-lilies, a ptarmigan eating cranberries or a water strider skimming across a pond. They'll feel sedge plants warming in the sun or hear frogs and toads croaking in the marsh grass.

The field trip should be to the best birding spot in your community. If you need help in finding a good place, check with your students, their parents, local bird-watchers, the Alaska Department of Fish and Game or the U. S. Fish and Wildlife Service.

If your school doesn't have money for field trips, take the students on bird walks on or near the school grounds. Encourage them to visit more distant birding locations after school or on week-ends. The field trip activity sheets in the student book are designed to be used individually or with the class. (Be innovative-- Lisa Jean Parkman of Anchorage once took her students on a bicycle bird trip!)

Be sure the group is quiet when you arrive at the site. Tell the students they need to sneak up on the birds. Often your best look at them is your first, before they've seen you.

Follow these excellent suggestions :

HOW TO LEAD A SUCCESSFUL BIRD WATCH (Adapted from Bird Kit, Portland State University, Portland, Oreg.)

1. Be enthusiastic. Don't worry if you don't know much about the birds.
2. Try to keep each group as small as possible. Four to six students with each adult leader or student helper is an optimum size.
3. Make sure everyone stays close together. This prevents rapid movements when a bird is spotted and also helps keep a group in touch with its leader.
4. Move slowly. This will prevent you from scaring the birds and enable you to see more. How much can you see when you're moving down the freeway at 55 mph?
5. Watch the trees, bushes or grasses for movement. Birds usually move around a lot and You can take advantage of this by letting your eyes go out of focus and scanning large areas with one glance. You are more likely to pick out movement in the trees using your peripheral vision than by trying to focus on specific branches.
6. Use your ears. Birds will often announce their presence by calling or singing. A noisy group will not be able to hear sounds as well as a quiet one. Noise doesn't always scare birds away.
7. When you spot something, stop.
8. Avoid making sudden movements if the bird is close by. Pointing it out with your arm might scare it away.
9. A trick for attracting birds that works quite well sometimes: Make a loud "pshh, pshh, pshh" sound through your teeth or kiss the back of your hand. Some birds will come within a few feet if you stay absolutely still.
10. Vary the speed of your walk. Helps keep student interest.
11. Before you go out bird-watching, assign various students to be "experts" in each of the bird groups. A few students may be "swimming bird experts," for example; others may be "perching bird experts" or "shorebird experts," etc. During the field trip, divide the experts so that each group has one of each.
12. Dogs like to go on walks, but they are no help at all on a bird walk. Leave them home.
13. Which direction should you walk in? If possible, walk away from the sun so that you have good light but are not dazzled by the glare.
14. Encourage students to use the field identification guides. Resist being an authority by saying "that's a so and so" : let them identify.
15. While watching the birds, try to observe what they're doing, where they're going, etc.

16. Time of day makes a difference in what birds you will see. Early morning is best, before sunset is next best, and the middle of the day is usually the worst time. But weather, the tide, or migration may affect the birds too. On tidal beaches, it's generally best to do your birding at high tide because the birds are more concentrated then. During migration, you are likely to see birds at any time of day, although they tend to be most active in the morning.

Materials:

- binoculars and spotting scopes on tripods
- plastic sandwich bags and one large garbage bag for each group of students
- pencil and clipboard (and plastic bag cover) for each group of students
- popcorn, bread crumbs, or fish (such as herring)
- rulers or measuring tapes for each student
- hand lenses
- thermometers
- kitchen strainers, nets
- large plastic container for field aquarium
- MAP TIME, worksheet 9A, FIELD NOTES, worksheet 9B, WETLANDS CHECKLIST, worksheet 9C, and student field guide
- large piece of cardboard, felt-tip marker, and small roll of transparent tape for each group
- first-aid kit
- matches /tinder for group leaders

Procedure:

1. Discuss the wetland area you'll be visiting before you go. Show the students a map. Review the information in this book on the habitat types found in the area. Check the library for additional information.

Have students review birds using their own field guide, which is organized by bird groups. Discuss these groups and, if you have other field guides, talk about the way they are organized. Mention field marks by which birds are identified- -size, bill, feet, etc.

2. Have a "dry run" of the field trip in class beforehand. Show the students pictures or slides of birds. Have them use their field guides to identify the pictures. Practice using binoculars and spotting scopes. Bring in plant samples and have students tell you about them. Talk about fish, mammals, amphibians, and invertebrates that you might see. Ask them to draw a mural with felt-tip markers on a large sheet of paper, predicting what may be seen on the field trip.
3. Stress conservation--the protection and wise use of our natural resources. Ask students how they can help take care of animals and plants they encounter in their field and classroom studies. Develop with student participation such rules as: step softly and quietly while observing animals; stay away















from nesting birds; replace rocks or logs after looking underneath (to keep the roofs on animal homes); handle animals gently; don't take live animals or plants away from their homes; throw trash in a garbage bag.

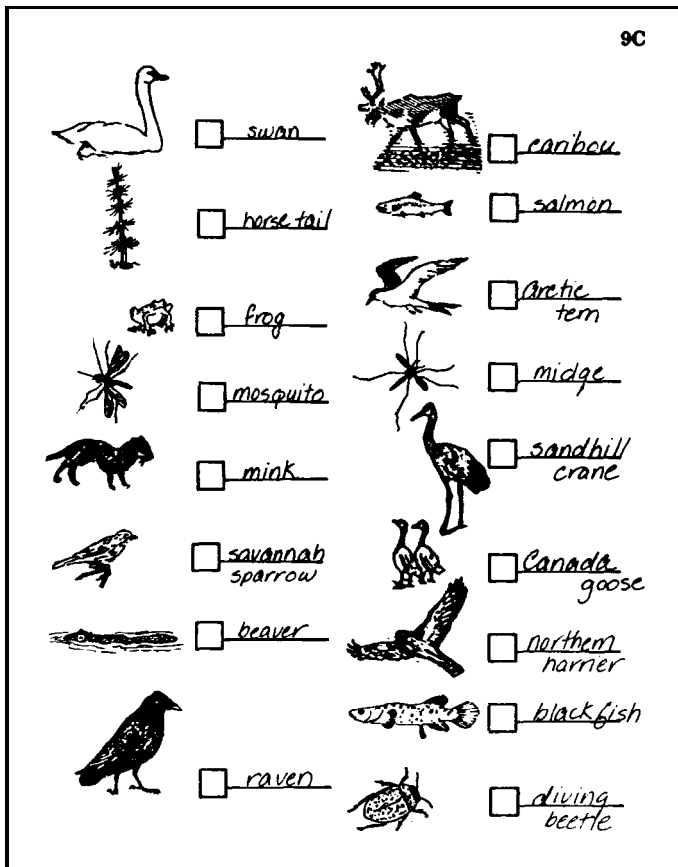
4. It is a good idea to discourage personal collections of any natural items, living or nonliving, so that other people can enjoy the area in the future. Limit collections to educational purposes such as art projects or aquarium study. Animals that are already dead can be preserved for classroom specimens, but return any living animals to their natural habitats as soon as possible.
5. Remember safety. Keep students in groups by using the buddy system or by using adult or older child supervision. Take a first-aid kit. Discuss hypothermia. Take matches and tinder for starting a warm-up fire if necessary. Make sure students dress warmly and take extra clothing and rain gear (plastic bags will do in a pinch). Mention the danger of falling into muskeg ponds - which may be deeper than they look. And wear life jackets on boat trips.
6. When you arrive at the bird-watching area, review the rules your class developed to protect the wetlands. Remind students to stay with their group. List any hazards to be avoided and agree on a time to reassemble.
7. Ideally, group leaders will

have visited the site previously and can head immediately for the field. Students should observe, name, and check birds on the WETLANDS CHECKLIST, worksheet 9C. Or create a checklist similar to this but specific to your area by cutting out and pasting local bird and plant pictures. Then have students work on FIELD NOTES worksheet 9B. At least one person in each group should take field notes on birds, fish, mammals, amphibians and invertebrates. Each group should make a plant collection. Use the kitchen strainers and nets to find insects in the water, on the land and in the air. Which birds eat these insects? Put the aquatic insects in a plastic field aquarium so that students can watch them. What role do insects play in the wetland?

9C
Wetlands Checklist

Write the names of these plants and animals on the lines. Check off the boxes as you see these species on your field trip.

	<input type="checkbox"/> ptarmigan		<input type="checkbox"/> moose
	<input type="checkbox"/> red fox		<input type="checkbox"/> harlequin duck
	<input type="checkbox"/> bald eagle		<input type="checkbox"/> spotted sand piper
	<input type="checkbox"/> caddis fly larvae		<input type="checkbox"/> cranberry
	<input type="checkbox"/> flounder		<input type="checkbox"/> muskrat
	<input type="checkbox"/> toad		<input type="checkbox"/> pintail
	<input type="checkbox"/> brown bear		<input type="checkbox"/> dipper



8. After the mid-point of your trip, ask the students:

- . What birds have you seen?
- . What have you seen that birds could eat?
- . What other interesting things have you seen?

Some birds might be lured in with popcorn, bread crumbs, or fish; then their behavior can be observed closely. Remind students to be quiet and still to encourage the birds. Ask them to close their eyes for a few minutes and listen to the sounds of the birds around them.

9. Have each group prepare a display by taping and labeling the items they collected on a large piece of cardboard. These displays can then be

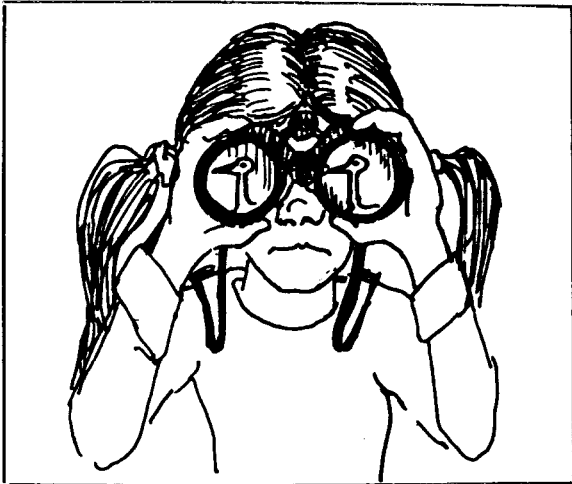
taken back to the classroom for judging and for follow-up learning activities. Students can check the accuracy of the plant labeling from the illustrations on their worksheets or in other plant books.

10. Play "gulls and crows" as a field trip finale once you are away from the bird-watching area. Divide class into two equal teams. Lay out a brightly colored home base line of heavy yarn. When true statements are read, the gulls chase the crows as the crows run toward home base. If the statement is false, the crows try to catch the gulls. Anyone caught joins the other team. Listed here are some possible statements.

- . Eagles are small perching birds. (F)
- . Black oystercatchers have long legs. (T)
- . Arctic terns have forked tails. (T)
- . The robin can swim. (F)
- . The red-throated loon has a yellow throat. (F)
- . The Steller's jay is the same as a blue jay. (F)
- . The rock ptarmigan is white all year. (F)
- . The great blue heron is blue-gray. (T)
- . Juncos eat fish. (F)
- . The short-eared owl is very wise. (F)
- . Canada geese fly in a v-shape. (T)
- . Bald eagles are not bald. (T)

(Contributed by Sherry Foster, Baranof Elementary School, Sitka)

11. Don't forget before you head for home to have each student evaluate the trip or tell what he or she liked best.
12. In a class later, summarize your data with WETLANDS FIELD TRIP SUMMARY, worksheet 9D. Look over your mural, and add new animals and plants.

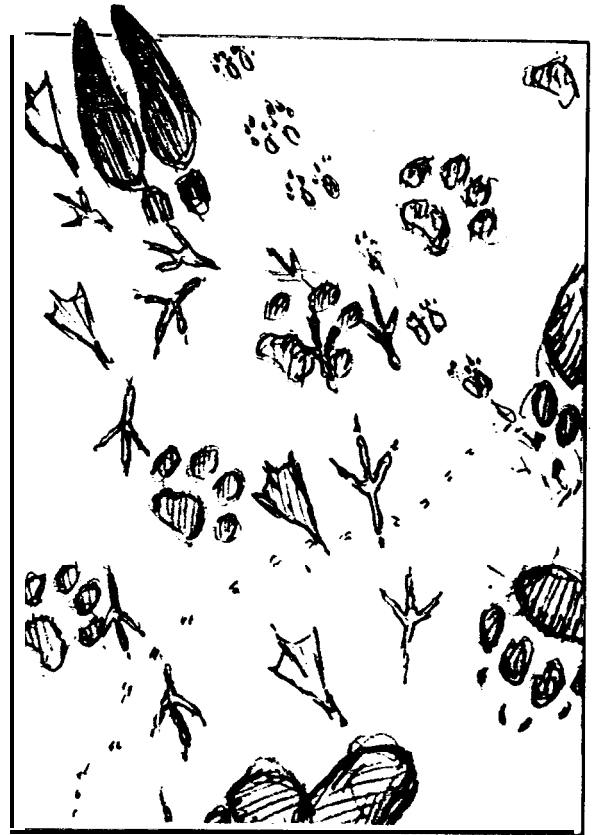
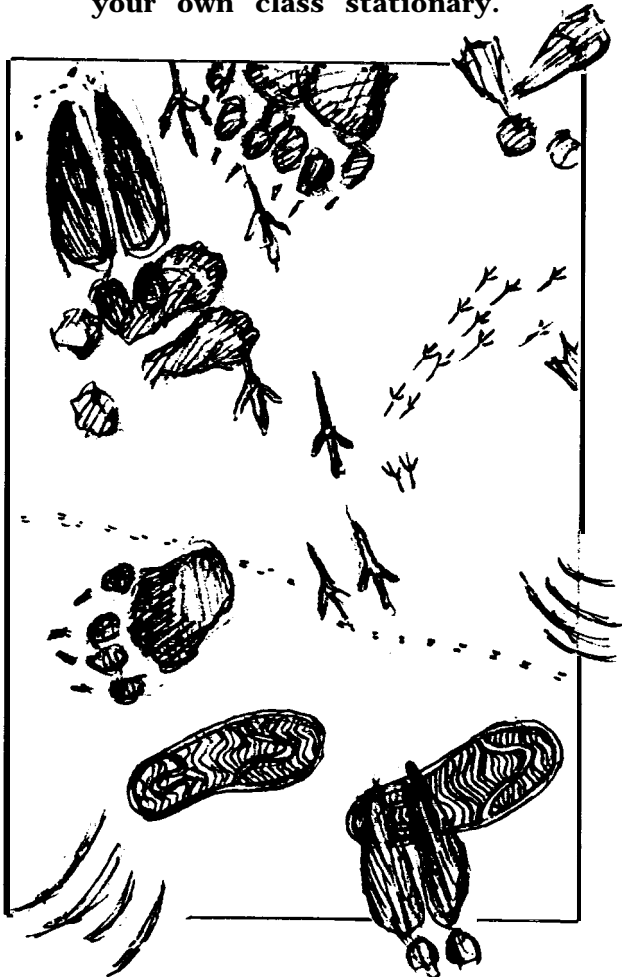


Additional Activities:

1. Language Arts, Science: Have students write stories or reports that might be given orally to your own class or some other class as a method of sharing Sea Week knowledge. Some suggested starters are :
 - . My bird adventure started with. . .
 - . I would like to be a bird, so that. . .
 - . I looked through my binoculars and suddenly . . .
 - . I wasn't afraid of walking though the marsh at night - - but then the sound began. . .
 - . Splash! Squish! Suddenly I fell into a bog. . .
2. Science, Art: Identify and illustrate the common wetland plants and animals of your area. (Plants might be pressed and labeled, pictures cut from books or magazines, pictures duplicated from books; or student can do their own drawings.)
3. Social Studies, Science: Think of the site of your Sea Week field trip as a possible development spot. Have the children help you create a list of alternative uses for the site (include present use). Divide the class into groups. Have each group choose one use. Have each group make two lists on newsprint or butcher paper based on their use selection: Benefits - - all the positive reasons for having the site used for a particular purpose. Costs - - all the possible negative effects of using the site for that purpose. Let each group report to the class. Discuss the alternatives as a class and add new ideas to the sheets. Then predict as a class what will happen. Will your class have any effect on the outcome? How can you make your opinions known? (Possibilities include talking to other people; talking to the decision makers; writing letters to the editor; preparing a report for the city or village council; or making up T-shirts or bumper stickers.)
4. Home Economics, Science: Have a wild foods dinner using edible wetlands plants. Get the help of parents and wild food experts. Have students help with the cook-

ing and prepare place cards with information about the plants. The Cooperative Extension Service's Wild Edible and Poisonous Plants of Alaska and Furlong and Pill's Edible? Incredible! Pondlife are good references (see bibliography).

5. Art, Science: Challenge students to be track experts. Observe bird and wetland tracks in the wilds. Olaus Murie's A Field Guide to Animal Tracks has some good background information. Then make potato track prints by carving potatoes. Roll thick poster paint or block printing ink onto the potato. Press the tracks on paper to create mysterious track stories and your own class stationary.



6. Science, Mathematics, Home Economics: Have a contest to see how many birds your students can see individually and as a class in one day. The students can make bird-shaped cookies as prizes.
7. Art, Science: Make a model of your wetland. Draw it on a big piece of cardboard. Use dried vegetation with cardboard or wooden fish and wildlife. You might even try making the model realistic by building it on sponges in a pan.
9. Art: Make grass or bark baskets or driftwood carvings from materials from your wetland. Ask local basket makers and carvers for assistance.

Unit Eleven

Wetlands Benefit People

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Wetlands are extremely valuable as habitats for fish and wildlife-- and they are also of immense value to people. Sue Quinlan stated it very well in her Alaska Wildlife Week materials Water, Wetlands, and Wildlife (pp. 4-6; see bibliography):

Just as mammals, migratory birds, and fish are drawn to Alaskan wetlands, so too are humans. Most of the Native people of Alaska have depended on wetlands ever since their ancestors crossed the Bering Land Bridge into North America. Most villages and hunting camps are and were located near Alaskan wetlands. Natives of western Alaska harvested the waterfowl that crowded the coastal wetlands each spring and

fall, gathered eider eggs from the barrier islands, and hunted belukha whales and spotted seals in the lagoons. Those people who moved inland tended to settle along rivers where fish could be caught from the rivers, berries gathered from the muskegs, and ducks hunted in the lakes and ponds. The muskrat, beaver, and otter that live in Alaska's interior wetlands led trappers to explore the remote areas of the Great Land. Even the gold miners who rushed to Alaska used the living resources of Alaska's wetlands to survive. Thus the trading posts and settlements of white men were also located near wetlands. How many of the villages and towns near your school are located on or near a wetland?

Today, as in the past, we Alaskans are drawn to our wetlands. We visit them to pick berries, hunt moose and bears, to trap muskrat and beaver, to fish, and for the chance to see a moose, or hear the honking of wild geese. Whether we realize it or not, most of us depend on wetlands for food and recreation. We depend on wetlands for other values too. Many freshwater wetlands store water from rain and snow. Wetland plants use much of the water that might otherwise rush down to flood our cities. Some wetlands also hold water back so it can seep down into the aquifer (underground water supplies) and keep our wells full of water. By releasing water slowly, wetlands keep our streams continuously flowing and prevent or lessen floods from heavy rains and snow. Wetland plants also stabilize the soil, prevent erosion of valuable land, and keep our rivers and lakes relatively free of silt and the waters clear and clean.

Despite all the values of wetlands, many people have, until recently, considered wetlands to be wastelands. Over 40 percent of the wetlands in the continental United States have been destroyed by draining, filling, dredging, and pollution.

The realization that wetlands are valuable has come late. Water pollution, changes in water temperatures from power plant discharge, changes in stream bottoms from erosion, and changes in the amount of water in wetlands caused by water diversion were all caused by people who did not understand the value of wetlands or the interconnections of marshes, rivers, lakes, and coastal estuaries. Although some areas are being returned to wetland status, many wetlands throughout the

world have been permanently destroyed. Even today over 300,000 acres of wetlands are lost every year in the continental United States alone.

When wetlands are changed too much or lost, so too are the wildlife that depend on wetlands. Much of Florida was once wetlands, but humans built cities, drained swamps, channelized wide rivers and built dams to control water. Now, Florida has more endangered species of wildlife than any other state in the United States except Hawaii. Most of these endangered species are wildlife that depend on wetland habitat. River otters, once found in all the major waterways of the United States and Canada, are now endangered or gone from 15 states and one Canadian province.

We are lucky in Alaska for we still have extensive areas of rich wetlands and enjoy plentiful wildlife. But change is coming quickly to our State. Even now 70 percent of our population lives along the coast, and most of our towns and cities are built right on top of wetlands. In many instances we are repeating the path of dredging, draining, and filling of wetlands that ultimately led to many problems and loss of wildlife in the continental United States.

Alaskan wildlife has already been affected by some loss of wetlands. Increased erosion from gold mining in the upper tributaries of the Yukon River is considered by biologists to be the reason that salmon runs in interior Alaska are now far lower than reported by early explorers. Throughout the State, small salt marshes and estuaries have been and are being dredged or filled to create more room for houses, airports, boat harbors, and staging areas for oil production. Water is being divert-

ed from streams for irrigation of agricultural land and drained from aquifers for human use. When too much is diverted or held back, wetlands dry up and the wildlife that depends on the wetlands disappear.

We Alaskans still have our wetlands. But we must recognize their values and interconnections and carefully protect them from draining, filling, and pollution. If we do not, we will soon find that our salmon are no longer abundant, the places to hunt moose and pick berries are far away, and the wild geese no longer return to mark the arrival of spring.


Worksheet 11A Wetland Values

After students have completed this activity, encourage them to apply the information to their own wetlands. How are they valuable?


11A

Wetlands Values


Directions: Number the pictures that go with each paragraph.




10




4



2




7




1

1. Alaskan wetlands are very important for migratory birds. Millions of waterfowl and waders nest in Alaska's muskeg, wet tundra, marshes, and coastal wetlands.
2. Fish, too, depend on wetlands. Alaska's salmon industry is based on wetland spawning and rearing areas. Grayling, pike and whitefish spend their entire lives in freshwater wetlands.
3. Bear, caribou, moose, mink, muskrat, otter and beaver live in Alaska's wetlands. These animals depend on the plants that grow rapidly in the long summer days. Some animals eat these wetland plants. Other animals eat the wetland animals that eat the plants.
4. Some tidal wetlands can grow more plant material than the best farm fields. And no one has to plant or fertilize a wetland. Farmer's crops can be measured in bushels per acre. But the crops from wetlands can be measured only by estimates of the numbers of fish, birds, mammals, clams and crabs in the area.
5. Alaska's Native peoples have known about wetland values for a long time. They have been depending on birds, fish, mammals and plants for food and clothing.


11A




11




5




9



6



3

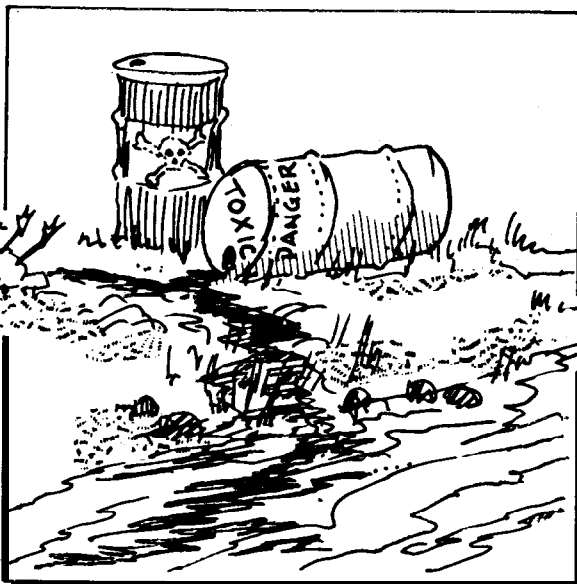


8

6. Today, Alaskans use wetlands for hunting, fishing, trapping, berry picking, and edible greens! We also use them for recreation - birdwatching, hiking, jogging, cross-country skiing, sketching and photography.
7. Wetlands help protect our villages and towns from flooding. They soak up extra rain and snow like a sponge. Then they release it slowly in drier times.
8. This stored water in wetlands helps keep our rivers, lakes and underground reservoirs full. That way, we have plenty of water for people as well as wildlife.
9. Wetlands filter water to help reduce pollution. Wetland plants take the nutrients from waste water (within limits) and use them for growth. Wetland plants also hold the soil. They help prevent soil erosion and help keep streams and rivers from filling up with mud and other sediments.
10. Wetlands serve as natural storm barriers. They protect animals, plants and people from waves and flooding.
11. When wetlands are changed too much or lost, wildlife populations decrease and the work done by wetlands--like storing and filtering water--is also lost. Over 40 percent of the wetlands in the lower 48 have been destroyed by draining, filling, dredging and pollution. We are lucky in Alaska, we still have lots of rich wetlands and plentiful wildlife. But change is coming quickly to our state.

Worksheet 11 B Wetland Habitat Protection Worksheet 11 C Wetlands Development

Ask students to think about wetlands protection and development in their own community. What did their community look like 5 years ago, 10 years ago, 50 years ago, 100 years ago? (They may need to check with long-time residents for these answers.) What structures have been built on wetlands? How has animal and plant life changed as a result of this building? What positive and not-so-positive things have happened as a result of this development? What does your class predict will happen in the future? What effect will your class have on birds and wetlands now and in the future?



Wetland Habitat Protection

1. List things that people do on wetlands which do not destroy the habitat.

- answers will vary -
- boating
- skiing
- canoeing
- hunting
- berry picking
- fishing
- flying



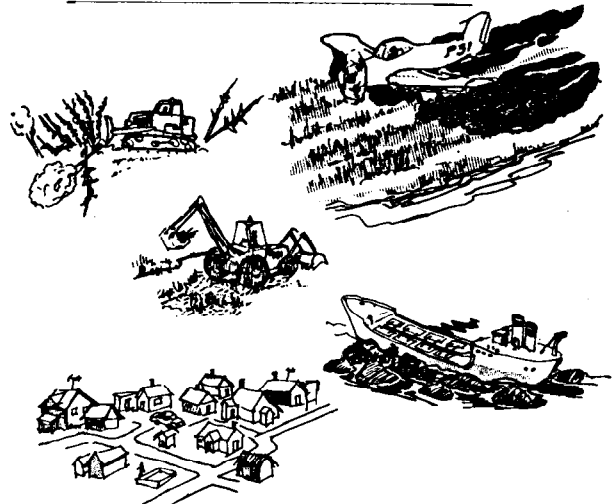
2. List some things that people have done in your area that do destroy wetland habitat for birds or other creatures.

- clear cutting
- dam building
- land development
- pollution; air, water + land
- disturbing stream beds
- building some roads



Some of these things may be necessary if we are going to have a place for people. Some could be done elsewhere. Which of the habitat-destructive items you listed probably could have been done someplace else?

- a. answers will vary
- b. land development
- c.
- d.
- e.
- f.



Bibliography

Compiled by Peggy Cowan, Belle Mickelson, Mary Lou King, Nancy Barr, and Dr. Earl Clark, associate professor, University of Alaska, Juneau, and his students Joyce M. Roloff, Linda Edmondson, Patricia Muchnick, Dan Penrose, Chris Winter, and Tom Castagnola.

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Children's Literature :

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Description of an estuary, plant and animal inhabitants and their interactions.

Andersen, Hans Christian. The Ugly Duckling. Contained in many collections and separate editions, including a Golden Book edition of Andersen's collected works, and a 32-page translation by R .P. Keigwin, illustrated by Toma Bogdanovic. Scroll Press, New York, 1971.

Ardley, Neil. Let's Look at Birds. Illustrated by John Rignall, Richard Millington and Graham Allen. Edited by Jennifer Justice. Derrydale, New York. 1977. 29 p.

An introduction to the birds of the world and their characteristics and behavior. Includes birds of the tropics, sea and shore, river, marsh, woods, fields and town--with gorgeous color illustrations.

Arnosky, Jim. A Kettle of Hawks and Other Wildlife Groups. Coward, McCann and Geoghegan, New York, 1975. 20 p.

Group names and the behavior and habitats of six different wild animals. Simple straightforward text; illustrations in greys and greens.

Baskin, Leonard. Hosie's Aviary. Viking Press, New York, 1979. 48 p.

Whimsical verse and beautiful watercolor bird illustrations.

Beauregard, Sue and Jill Fairchild. Sea Birds. Sea Library Cypress. 1977.

Small-format photographs, simple text.

Benson, D.E. Helping Wildlife : Working with Nature. Wildlife Management Inst., 709 Wire Building, 100 Vermont Ave. NW, Washington, DC 20005.

Excellent booklet on ecological principles, illustrated cartoon-style.

Blassingame, Wyatt. Wonders of Frogs and Toads. Dodd, Mead and Co., New York, 1975. 80 p.

Explains life cycle of frogs and toads and describes categories. Photos.

Bonnors, Susan. A Penguin Year. Delacorte Press, New York, 1981. 48 p.

The drama of a year in the life of two Antarctic penguins; scientifically accurate text and illustrations.

Brenner, Tony. How Birds Live. Usborne Publishing, London. 47 p.

Various worldwide bird species in their habitats. Attractive full-color illustrations.

Buck, Lewis. Wetlands : Bogs, Marshes and Swamps. Parents' Magazine Press, New York, 1974. 64 p.

Explains how bogs, marshes and swamps develop. Biology presented in simple, straightforward manner.

Busch, Phyllis S. Wildflowers and the Stories Behind Their Names. Paintings by Anne O. Dowden. Charles Scribner's Sons, New York, 1977. 88 p.

Over 60 accounts of familiar species.

Carrick, Carol and Donald. Beach Bird. Dial Press, New York, 1973. 32 p.

Sea lore and close-up of beach plants, animals, and food chain; the story is about a day in the life of a gull.

Cole, Joanna. A Chick Hatches. Photos by Jerome Wexler. Morrow Junior Books, 1976. 47 p.

Twenty-one days of egg incubation chronicled in photographs.

Crosby, Alexander L. Canada Geese. Garrard Publishing Co., Champaign, Ill., 1966. 64 p.

A Junior Science Book that tells about the courtship, mating patterns and life cycle of Canada geese through a factual account of the author's experiences with the geese that lived at his pond for six weeks. Stresses the need for conservation. Black and white photos.

Darling, Louis. Greenhead. William Morrow and Co., New York, 1954. 95 p.

The saga of Greenhead, a male mallard, explores duck migration, natural enemies, and how man has upset the balance of nature. The text contains an abundance of biological terms but everything mentioned is illustrated in detail in shades of black and white.

Darling, Louis. The Gull's Way. William Morrow and Co., New York, 1965. 96 p.

Personal observations on gulls over a six-week period. Detailed descriptions of the island where Louis Darling set up his tent, courtship rituals, nest building, and parent-chick relationships. Black and white and color photographs, and charcoal and pen drawings.

Dobrin, Arnold. Marshes and Marshlife. Coward, McCann and Geoghegan, New York, 1969. 48 p.

Abundant life forms and ecology of a salt marsh are clearly and interestingly described.

Downs, Barbara. Alaskan Birds Coloring Book. Arctic Audubon Society, P.O. Box 82098, College, AK 99708.

Full-page illustrations with brief text at the bottom of each page. Covers 31 Alaskan species; coloring guide in back.

Earle, Olive L. Birds of the Crow Family. Morrow Junior Books, New York, 1962. 63 p.

Eimerl, Sarel. Gulls. Simon and Schuster, 1969. 64 p.

Lively account of behavior and characteristics of gulls. Describes about 40 varieties. Excellent discussion of instincts. Black and white photos.

Farrar , Richard. The Hungry Snowbird. Coward, McCann and Geoghegan, Inc., New York, 1975.

A young girl observes a junco that comes to her feeder.

Fegely , Thomas D . Wonder of Wild Ducks. Dodd, Mead and Co., New York. 80 p.

Contains information about many ducks found in Alaska.

Flack, Marjorie and Kurt Wiese. The Story About Ping. Viking Press, New York, 1961.

Classic story about a duck's adventures on the Yangtze River.

Freedman, Russell. How Birds Fly. Holiday House, New York, 1977. 64 p.

Simple explanation of bird flight.

Freschet , Berniece. The Flight of the Snow Goose. Illustrated by Jo Polseno . Crown Publishers, Inc., New York, 1970. 40 p.

Follows the leader of a flock of snow geese from the Sacramento Valley to and from Alaska. Describes the passing of the seasons and various dangers encountered by the geese during their migration: hunters, oil slicks and blizzards. Pictures are charcoal black and white.

Freschet , Bernice. Year on Muskrat Marsh. Illustrated by Peter Parnall. Charles Scribner's Sons, New York, 1974. 56 p.

Rhythm of the changing seasons and its effect on the marsh inhabitants.

Gans, Roma. Birds Eat and Eat and Eat. Thomas Y. Crowell Co. , New York, 1963.

A Let's Read and Find Out Science Book about bird behavior.

Gans, Roma. Birds at Night. Illustrated by Alik. Thomas Y. Crowell Co., New York, 1968. 33 p.

A Let's Read and Find Out Science Book that describes birds' sleeping habits and how eyes, feet and feathers protect them at night.

Garelick, May. What's Inside? Scott, Foresman and Co., New York, 1965.

Photographic series about a young goose from egg through early life.

George, Jean Craighead. Gull Number 737. Thomas Y. Crowell Co. , New York, 1964. 198 p.

Informative book about a boy who comes into manhood when his father's gull research is called on to avert a catastrophe.

George, Jean Craighead. Hook a Fish, Catch a Mountain. E.P. Dutton, New York, 1975. 129 p.

Young dancer from New York City and her cousin in Wyoming set off to find out where the cutthroat trout, which she caught, spawned. They take a bottom sample to discover what the fish are eating and watch the mayfly dance and breed.

Golden, Augusta. Ducks Don't Get Wet. Illustrated by Leonard Kessler. Thomas Y. Crowell Co., New York, 1965. 34 p.

A Let's Read and Find Out Science Book about duck preening and eating habits. Excellent hands-on experiments are provided in the text, and elementary analogies illustrate diving ability, migration and speed of flight. Color illustrations.

Gordon, Esther and Bernard. If an Auk Could Talk. Henry Z. Walck, Inc., New York, 1977,

A gentle reminder that birds can become extinct. Humorous illustrations.

Graham, Ada and Frank. Birds of the Northern Seas. Photos by Les Line. Doubleday, New York, 1981. 88 p.

Delightful book on storm petrels, auks, kittiwakes and puffins--mating and survival.

Hader, Berta and Elmer. Quack, Quack : The Story of a Little Wild Duck. Macmillan Publishing Co., New York, 1961. 48 p.

Story of a duck captured by a farm boy, told in a charming but not maudlin manner.

Hancock, David. Adventure with Eagles. Photos by David and Lyn Hancock. Wildlife Conservation Centre, B.C., Canada, 1970.

Author's travels through British Columbia. Covers eagles, their nesting grounds and habits, and other animals (puffin, sea lion and killer whale) in their environment. Discusses problems to habitat caused by pesticides, herbicides, and human disturbance.

Hawkinson, Lucy and John. Birds in the Sky. Childrens Press, Chicago, - 1965. 32 p.

Highly recommended picture story book on the excitement of bird watching. Descriptive phrases: "Gulls that wheel and dip". .. "Ducks are swift and sure. They beat their wings fast as they rise and turn." Beautiful watercolor illustrations.

Hoff, Syd. Albert the Albatross. Harper and Row, Evanston. 31 p.

Albatross is blown inland by a storm and has trouble finding way back.

Holman, Felice. Elisabeth and the Marsh Mystery. Illustrated by Erik Blegvad. Macmillan Publishing Co., 1966. 49 p.

A well-told, informative story. Children try to identify strange calls from the marsh and learn about bird migration.

Hopf, Alice Lightner. Biography of a Snowy Owl. G.P. Putnam's Sons, New York, 1979. 62 p.

Traces the life cycle of the owl in its arctic tundra habitat.

Hungerford, Harold R. Ecology: The Circle of Life. Children's Press, Chicago, 1971. 92 p.

Struggle for life in a forest and a pond. Explains food chains, food webs, human interactions, ecology and the concept of community.

Hurd, Edith Thatcher. Sandpipers. Illustrations by Lucienne Block. Thomas Crowell Co., 1961. 34 p.

Hurd, Edith Thatcher. The Blue Heron Tree. Illustrated by Clement Hurd. Viking Press, New York, 1968. 66 p.

Chronicles Big Blue's migration, mating and nesting in lyrical, sensitive language. Provides a wealth of information on the heron life cycle and habits. Woodcut illustrations.

Hutchins, Ross E. The Last Trumpeters. Illustrated by Jerome P. Connolly. Rand McNally and Co., 1967. 64 p.

Portrays the migration of the trumpeter swan from North Carolina, California, the Mississippi Valley and Gulf Coast to and from the Arctic Ocean. Details of nest building, preening, egg laying, rearing of young. Beautiful pastel watercolors with ink.

Kaufman, John. Animal Travelers. Greenwillow Books, New York, 1977. 55 p.

Describes in simple language the migration of gray whales, as well as caribou, barn swallows and painted lady butterflies.

McClung, Robert M. Honker: The Story of a Wild Goose. Illustrated by Bob Hines. William Morrow and Co., New York, 1965. 64 p.

Covers one year in the life of Honker, the leader of a flock of Canada geese; stresses the importance of refuges, banding and tracking. Illustrations are black and white and charcoal.

Mites, Miska. Beaver Moon. Illustrated by John Schoenherr. Little, Brown and Company, Boston, Toronto, 1978. 31 p.

Survival is the theme of this story of an old beaver's flight from his former lodge. Pond community including bobcat, bear and muskrat also introduced.

Oxford Scientific Films. The Stickleback Cycle. Photographs by David Thompson. G.P. Putnam's Sons, New York, 1979. 30 p.

Brief descriptive text followed by clear and outstanding close-up photos.

Parnall, Peter. A Dog's Book of Birds. Illustrated by author. Charles Scribner's Sons, New York, 1977. 43 p.

Engaging picture book humorously tells story of a dog's encounters with birds such as the blue heron, pelican and albatross. Factual information is blended with fantasy. Detailed ink illustrations.

Peterson, Roger Tory. Birdwatching with Roger Tory Peterson. National Wildlife Federation, 1412 16th Street NW, Washington, DC 20036. 1973. 16 p.

Pamphlet with tips for bird watching; lots of color pictures.

Peterson, Roger Tory and Peter Alden. A Field Guide to the Birds Coloring Book. Illustrated by John Sill. Houghton Mifflin Co., Boston, 1982. 64 p.

Line drawings and brief descriptions of 262 common North American birds. Inside covers have small color illustrations of each bird.

Pringle, Laurence. Water Plants. Thomas Y. Crowell Co., New York, 1975. 33 p.

Drama of a food web--the importance of pond flora is featured as a frog journeys through a pond and is eventually eaten by a pickerel, which is in turn consumed by a heron.

Puccinelli, Marie. The Time of the Puffins. Illustrations by John Kaufman. Bobbs-Merrill Co., Indianapolis, 1965. 35 p.

Delightful, informative book about the puffin's life.

Reid, G. K. Pondlife. Golden Press, New York, 1967. 160 p.

The best pocket guide to life in and around ponds and streams. Packed with color drawings. Golden Nature Guide series.

Robards, Fred and Allan Taylor. Bald Eagles in Alaska. U. S. Dept. of the Interior, U. S. Fish and Wildlife Service in cooperation with Forest Service, U.S. Govt. Printing Office, Washington, DC. Stock No. 796-130. 1976. 12 p.

Pamphlet with color photos and text.

Robertson, Keith. In Search of a Sandhill Crane. Viking Press, New York, 1973, 200 p.

City boy learns about the wilderness, cranes, and himself during a summer with his aunt in northern Michigan, spent trying to get pictures of nesting cranes.

Scott, Jack Denton. Canada Geese. Illustrated by Ozzie Sweet. G.P. Putnam's Sons, New York, 1976. 64 p.

Close attention is given each aspect of goose life: selection of a mate, birth and caring for the young, and death. Man's intervention in nature is portrayed as one of helping maintain the balance. A table of "goose talk" is provided. Black and white photos.

Selsam, Millicent. Tony's Birds. Illustrated by Kurt Werth. Harper and Row, New York, 1961. 64 p.

A Science I Can Read book about how a boy begins to observe and learn about birds.

Selsam, Millicent. First Look at Birds. Walker and Co., New York, 1973.

Shepherd, Elizabeth. Arms of the Sea; Our Vital Estuaries. Lothrop ; Lee and Sheperd Books, New York, 1973. 160 p.

Describes estuaries, fish, birds and animals that depend on them for life. Photos.

Smith, Frances C. The First Book of Swamps and Marshes. Franklin Watts, Inc., 1969. 64 p.

Poetic prose portrays some of America's wetlands. Carefully written and well designed.

Spizzirri, Linda. An Educational Coloring Book of Birds. Caroline House, Aurora, Ill., 1981. 32 p.

Full-page illustrations of wide range of bird life face pages of biological data and information in outline form.

Stone, Harris A. The Last Free Bird. Illustrated by Sheila Heins. Prentice-Hall, Englewood Cliffs, N. J., 1967.

Message is to save our environment. Beautiful watercolors illustrate this fictional picture book.

Toye, William. The Loon's Necklace. Pictures by Elizabeth Cleaver. Oxford University Press, New York, 1977. 24 p.

Enchanting picture book account of Tsimshian Indian legend of how the loon received a collar and speckles on its back by helping a blind man.

Tresselt, Alvin. Rain, Drop, Splash. Illustrated by Leonard Weisgard. Lothrop, Lee and Sheperd Books, New York. 1946. 26 p.

Picture book following the journey of a raindrop to the sea.

Tresselt, Alvin. The Beaver Pond. Illustration by Roger Duvoisin. Lothrop, Lee and Sheperd Books, New York, 1970. 32 p.

Simple, poetic description of construction of beaver pond and interdependence of animals.

Turkle, Brinton. Thy Friend, Obadiah. Viking Press, New York, 1969. 37 p.

A good old-fashioned story about a Quaker boy and a seagull.

Usborne First Nature Books. Birds. Hayes Books, 8141 East 44th St., Tulsa, OK 47145.

Colorfully and attractively illustrated introduction to bird life and habits. Good, simple biological overview.

Vessel, Matthew F. and Herbert H. Wong. Beach Birds. Illustrated by Ron King. Western Outdoor Environmental Guides, Chevron Chemical Co., Educational Aids, 200 Bush St., San Francisco, CA 94120.

Lots of good information and watercolor illustrations.

Voronin, Sergei. Nine White Swans. Translated from the Russian by Fainna Glagoleva. Drawings by Tikapustina. Progress Publishers, Moscow, 1973. Distributed by Imported Publications, Inc., 320 W. Ohio St., Chicago, IL 60610.

Story of a swan family, Large print, with beautiful watercolors.

Wildsmith, Brian. The Little Wood Duck. Franklin Watts, Inc., New York, 1973. 31 p.

Wood ducks are not found in Alaska, but this book will help students conceptualize the duck's environment and natural enemies. Bright, cheerful watercolors by author.

Wilkins, Marie. The Long Ago Lake. Illustrated by Martha Weston. Charles Scribner's Sons, New York, 1968. 160 p.

Story of summers in the 1930s on a Wisconsin lake shore. Shares nature lore, craft ideas and joys of childhood on a lake.

Wright, Dare. Look at a Gull. Random House, New York, 1967. 41 p.

A photographic essay on the hatching and growth of a seagull.

Teacher's Reference:

Alaska Department of Fish and Game Nongame Wildlife Program: Alaska Wildlife Watcher Reports : Winter Bird Feeding in Alaska, Landscaping for Wildlife in Alaska, Birdhouses for Alaska. ADF&G Nongame Wildlife Program, 333 Raspberry Road, Anchorage, AK 99502.

Helpful pamphlets at no cost.

Alaska Wildlife Notebook Series. Alaska Department of Fish and Game, P. O. Box 3-2000, Juneau, AK 99802.

Excellent descriptions of Alaskan animals. Includes feeding habits, range, life histories. Illustrated with line drawings.

Amos, W.H. The Life of the Pond. McGraw-Hill Book Company, New York. 1967. 232 p.

Stresses ecological relationships. Has many color photos and fine line drawings. One of the Our Living World of Nature series developed in cooperation with The World Book- Encyclopedia.

Andrews, Williams. Freshwater Ecology. Prentice-Hall, Englewood Cliffs, N.J., 1972.

Angell, Tony. Marine Birds and Mammals of Puget Sound. Drawings by Tony Angell. Washington Sea Grant, University of Washington Press, Seattle WA 98105. 1982. 160 p.

The Alaska Fisherman's Journal says, "This book is worth the price for Tony Angell's drawings alone--and there is much more.. .Descriptions of the various species--grebes, gulls, terns, seals, sea lions, dolphins, whales--are detailed succinctly and sometimes written with passion. " All species featured are found in Alaska. Maps, tables, bibliography.

Armstrong, Robert H. and the editors of Alaska Magazine. A New, Expanded Guide to the Birds of Alaska. Alaska Northwest Publishing Co., Anchorage, 1983. 332 p.

Species descriptions and range information on Alaskan birds. Color photographs. Indispensable for bird watching in Alaska.

The Audubon Nature Encyclopedia, Vol. 8. Ponds. Curtis Publishing Co., New York, 1965.

Overview of ponds. Describes the living community patterns. Clear, brief definitions and explanations.

Austin, Oliver L. Water and Marsh Birds of the World. Illustrated by Arthur Singer. Golden Press, 1967. 223 p.

Natural history of major groups of water and marsh birds.

Bellrose, Frank. Ducks, Geese and Swans of North America. Stackpole Books, Harrisburg, Pa., 1976. 544 p.

Detailed descriptions of waterfowl and their habits. Includes range information and full page maps of migration routes for each species. Color plates of adults and young.

Bent, Arthur Cleveland. Life Histories of North American Gulls and Terns. Dover Publications, 1963.

Republication of classic 1921 work of bird lore, presenting species by species observational data on breeding, range, life cycle and habits. Also see others in Life History series.

Bradbury, Wilbur. Birds of Sea, Shore and Stream. Time-Life Films, Inc. , 1976. 127 p.

Excellent photos and text in picture book format, based on television series Wild, Wild World of Animals.

Burt, William H. A Field Guide to the Mammals. Illustrated by Richard P. Grossenheider. Houghton Mifflin Co., Boston, 1964. 284 p.

Excellent descriptions, pictures, and range maps of mammal species found north of Mexico. One of the Peterson Field Guide Series.

Cooperative Extension Service. Wild Edible and Poisonous Plants of Alaska. University of Alaska, Publication No. 28, 1981. 91 p.

Pocket field guide containing line drawings and some color photographs of a wide range of herbaceous Alaskan plants. Text provides descriptions, habitat, range and information on preparation of edible species.

Furlong, M. and V. Pill. Edible? Incredible ! Pondlife. Naturegraph Publishers, Inc., Happy Camps, Calif. 1972.

Photographs and text describe pondlife and how to prepare it as food. Helpful hints on where to find species.

Gabrielson, Ira N. and Frederick C. Lincoln. The Birds of Alaska. Illustrated by Olaus J. Murie and Edwin R. Kalmbach. Stackpole Co. , Harrisburg, Pa. and Wildlife Management Inst., Washington, DC. 1959. 922 p.

Comprehensive treatment of physical characteristics and behavior of each species. Full-color illustrations, gazetteer and bibliography.

Headstrom, Richard. A Complete Field Guide to Nests in the U.S. Ives, Washburn, Inc., New York, 1970. 451 p.

Nests of birds, mammals, insects, fish, reptiles and amphibians.

Heller, Christine. Wild Flowers of Alaska. Christine A. and/or Margaret E. Heller, Portland, Oreg., 1966. 104 p.

Handy identification guide, organized by color; photos of each flower.

Hicks, J.L. A Closer Look at Birds. Illustrated by John Rignall. Franklin Watts (Archon Press Ltd.), New York, 1976. 31 p.

Good treatment of varied topics. Alaskan birds mentioned include puffin (flying); eagle and albatross (ways of flying); blue heron and ducks (different feet); plovers and ducks (colors to blend); herring gull (eggs and hatching); and arctic terns and cranes (migration).

Hines, Bob. Ducks at a Distance. United States Dept. of Interior, Fish and Wildlife Service, U.S. Government Printing Office, Washington, DC 20402. Stock No. 024-010-00442-8. 1978. 53 p.

Handy field identification guide. Good color illustrations.

Hodge, Robert P. Amphibians and Reptiles in Alaska, the Yukon and Northwest Territories. Alaska Northwest Publishing Co., Anchorage, 1976. 89 p.

Natural history, descriptions, range maps, photos and drawings.

Horwitz, E.L. Our Nation's Wetlands. An Interagency Task Force Report. U. S. Government Printing Office, Washington, D. C. 20402. Stock No. 041-011-0045-9. 1978. 70 p.

Describes various types of wetlands and their importance nationally. Many photographs and drawings.

Hulten, Eric. Flora of Alaska and Neighboring Territories. Stanford University Press, Stanford, Calif., 1968. 1008 p.

The standard comprehensive flora, with technical descriptions of Alaska plants. Line drawings and range maps make it usable by non-scientists.

Iker, S. Look What We've Done to Our Wetlands. National Wildlife, June-July, 1982, Vol. 20, 4 p.

Jensen, Amy E. The How and Why Wonder Book of Mushrooms, Ferns, and Mosses. Grossett and Dunlap, New York, 1965. 44 p.

Scientific information and interesting tales and superstitions about flowerless plants in the plant kingdom.

Johnsgard, Paul A. Waterfowl, Their Biology and Natural History. University of Nebraska Press, 1973.

All genera and species of the world's waterfowl are pictured and described, including those that have become extinct.

Kessel, Brina and Daniel D. Gibson. Status and Distribution of Alaska Birds. Cooper Ornithological Society, Los Angeles, Calif., 1978. 100 p. Available from the University of Alaska Museum, Fairbanks, Alaska 99701.

Kierian, John. An Introduction to Wild Flowers. Hanover House, New York, 1952. 77 p.

Arranged chronologically by when they blossom; information on 100 common wildflowers, primarily of eastern U.S. Lovely color illustrations.

Klots, Elsie B. A New Field Book of Freshwater Life. G .P. Putnam's Sons, New York, 1966. 398 p.

Excellent descriptions and line drawings of a wide variety of wetland plants and animals.

Levinson, Marc. Nurseries of Life. National Wildlife. National Wildlife Federation, 1412 16th Street NW, Washington, DC 20036. Vol. 22, No. 2, Feb-Mar., 1984. pp. 19-21.

Description of wetland status nationally.

Lincoln, Frederick C. Migration of Birds. Revised by Steven R. Peterson. Illustrated by Bob Hines. U.S. Dept. of the Interior, Fish and Wildlife Service. U.S. Government Printing Office, Washington, DC 20402. Circular 16, 1979. 16 p.

Pamphlet answers many questions about migration.

Morrow, James E. Freshwater Fishes of Alaska. Illustrated by Marion J. Dalen. Alaska Northwest Publishing Co., Anchorage, 1980. 248 p.

Detailed descriptions of Alaskan freshwater fish. Line drawings. Also available is a shorter version by the same author: Illustrated Keys to the Freshwater Fishes of Alaska, 78 p . Same publisher.

Murie, E. The Alaskan Bird Sketches of Olaus Murie. Alaska Northwest Publishing Co., Anchorage, 1979. 57 p.

Excerpts from field notes and superb watercolors by Olaus Murie, a naturalist who traveled extensively in Alaska in the 1920s and 1930s.

Murie, Olaus J. A Field Guide to Animal Tracks. Houghton Mifflin Co., Boston, 1975. 375 p.

Describes tracks and other animal signs. Many of the fascinating stories happen in Alaska. Illustrated by line drawings. One of the Petersen Field Guide Series.

National Audubon Society. Audubon. National Audubon Society, 1950 Third Avenue, New York, NY 10022.

The monthly magazine of the National Audubon Society. Many articles on birds and wetlands, together with gorgeous photographs and news of conservation interest.

National Geographic Society. Field Guide to the Birds of North America. National Geographic Society, Washington, DC. 1983. 464 p.

One of the best field guides, with range maps, species descriptions and color illustrations.

National Wildlife Federation. National Wildlife. National Wildlife Federation, 1412 16th Street NW, Washington, DC 20036.

The bimonthly magazine of the National Wildlife Federation. Many articles on birds and wetlands, with photos and news of conservation interest. NWF also publishes International Wildlife, Ranger Rick and Your Big Backyard.

Needham, James G. and Paul R. A Guide to the Study of Freshwater Biology. Holden-Day, Inc., San Francisco, Calif., 1967. 107 p.

Line drawings of many different invertebrates; instructions for making sampling equipment.

Niering, William A. The Life of the Marsh. McGraw-Hill Book Co., New York, 1966. 232 p.

Emphasizes ecological relationships. Color photos and line drawings. One of the Our Living World of Nature Series developed in cooperation with The World Book Encyclopedia.

Pennak, Robert W. Fresh-water Invertebrates of the United States. Wiley, New York, 1978. 803 p.

Storehouse of information about invertebrates; photos and line drawings.

Peterson, Roger Tory. A Field Guide to Western Birds. Houghton Mifflin Co., Boston, 1961. 366 p. Paperback and hard cover.

Descriptions of birds, their habits, habitats and field marks. Illustrated with color and black and white plates. One of the Peterson Field Guide Series.

Peterson, Roger Tory and Frances Tenenbaum. A Field Guide to Wildflowers Coloring Book. Illustrations by Roger Tory Peterson and Virginia Savage. Houghton Mifflin Co., Boston, 1982. 64 p.

Illustrations and descriptions by habitat, i.e., woods, fields, wetlands, sandy soil. Full-color illustrations of each flower on the cover as a model for student coloring.

Pringle, Laurence. Estuaries: Where Rivers Meet the Sea. Macmillan Book Co., New York, 1973. 55 p.

Describes estuary's physical characteristics, its flora and fauna.

Putnam, Alice. The Whistling Swans. Illustrations by Scott Hiestand. Julian Messner, New York, 1981. 56 p.

Begins with swans spending the summer in Alaska, then migrating south to the Pacific coast, Mississippi River Valley and Atlantic Coast, and returning to Alaska the following summer. Obstacles include encounters with its natural enemies, man and inclement weather, as well as oil slicks and polluted water. Pen and ink illustrations.

Rand, Austin L. American Water and Game Birds. E.P. Dutton and Co., New York, 239 p.

Encyclopedic reference, prepared in cooperation with Chicago Natural History Museum. Detailed illustrations.

Reid, George K. and Richard D. Wood. Ecology of Inland Waters and Estuaries. D. Van Nostrand, 1976. 375 p.

Introduction to principles of aquatic ecology.

Ripper, Charles L. Diving Birds. Illustrated by Charles L. Ripper. William Morrow and Co., New York, 1967. 64 p.

Detailed information on diving birds, and characteristics of the loons, grebes, cormorants and anhingas. Touches on bird evolution and the uses of cormorants for centuries by Chinese and Japanese fishermen. Pen and ink illustrations.

Robbins, Chandler S., B. Bruun and H.S. Zim. Birds of North America. Golden Press, New York, 1966. 340 p. Paperback and hard cover.

Descriptions of birds and their habits, songs and ranges--illustrated with color drawings. Easy to use in the field but background information is limited.

Salken, L.D. Estuary: What a Crazy Place. National Wildlife Federation, 1412 16th St. NW, Washington, DC 20036. 1972. 19 p.

Little pamphlet that explains the importance of estuaries.

Saunders, David. Sea birds. Illustrated by Ken Lilly. Knowledge through Color, Grosset and Dunlap, New York. 1971. 159 p.

Excellent color pictures of ocean birds such as penguins, gulls, and pelicans ; maps and descriptions.

Sutton, George Miksch. High Arctic; an Expedition to the Unspoiled North. Photos by David F. Parmelee (and others). Paul S. Ericksson, New York, 1971. 219 p.

Famous American bird artist captures the subtle beauty of the north with color-plate illustrations and narrative.

Teal, John and Mildred Life and Death of the Salt Marsh. Illustrated by Richard G. Fish. Little, Brown and Co., Boston. 1969. Also available in paperback. Ballentine Books, New York. 1974.

Tells the past and present of east coast marshes in a novel-like style. Good background on the importance of wetlands and their ecology.

Terres, J.K. The Audubon Society Encyclopedia of North American Birds. Alfred A. Knopf, New York, 1980.

Tinbergen, Niko. The Herring Gull's World. 1960. 225 p.

Classic, fascinating study of all aspects of herring gull behavior.

Tuck, Gerald. A Guide to Seabirds on the Ocean Routes. Collins, St. Jame's Place, London, England, 1980. 144 p.

Descriptions of seabirds commonly seen on various ocean voyages together with a few black and white line drawings. Combines world geography and birds for armchair travelers--or student report writing!

United States Department of the Interior, Fish and Wildlife Service. What You Should Know Before You Build, Drain, Dredge, or Fill In Wetlands. Available from U.S. Fish and Wildlife Service, 1011 E. Tudor Road, Anchorage, AK 99503.

Photo-illustrated pamphlet that describes the permit process.

Vardaman, James M. Call Collect, Ask for Birdman. St. Martin's Press, New York, 1980. 247 p.

Story of the author's exciting attempt to see 700 birds in one year. Includes several chapters on Alaska birding.

Ursin, Michael J. Life in and Around the Salt Marshes. Thomas Y. Crowell co., New York, 1972. 100 p.

Good explanation of marshes and the impact of human activity, with a detailed explanation of creatures and features of salt marshes of the southeastern United States.

White, Helen, ed. The Alaska-Yukon Wildflowers Guide. Alaska Northwest Publishing Co., Anchorage, 1974. 218 p.

Field guide to Alaska's most common flowers. Brief descriptions including habitat and range accompanied by color photograph of each species.

Game :

Yotta Know Waterfowl, Yotta, Inc., 417 Denny Way, Seattle, WA 98109. 1982.

Board game for two to four players with 54 North American waterfowl on cards. Average playing time seven to ten minutes. Handicap system so that beginners can compete with experts. A birds and mammals card set is available that can be used with the same board.

Records :

A Day in Algonquin Park. Produced by William H. Gunn. Houghton Mifflin Co., Boston.

Voices of the forest, marsh, and lake through a summer's day from dawn to dusk in Algonquin Provincial Park, Ontario, Canada.

Voices of the Night: The Calls of 34 Frogs and Toads of the United States of America. Produced by Peter Paul Kellogg and Arthur A. Allen. Houghton Mifflin Co., Boston.

Curricula :

Arastasou, Kip . The Creek Book. Western Education Development Group, The University of British Columbia, Vancouver, B.C. 1978. 40 p.

A variety of activities and experiments. Illustrated with fine line drawings.

Hoebel, Michael. The Pond Book. Western Education Development Group, The University of British Columbia, Vancouver, BC., 1977. 40 p.

A variety of activities and experiments illustrated with fine line drawings .

Naturalists in the Schools Program. Bird Kit: A Resource for Teachers. Naturalists in the Schools Program, Environmental Education Project, School of Education, Portland State University, Portland, OR 97207. 1979. 104 p.

Activities on classification, adaptation, behavior, identification, predator-prey relationships, and birds and humans for K-8 students.

Newton, David E. and Irwin L. Slesnick. Hanging on to the Wetlands. Western Washington University, Bellingham, Wash., 1981. 47 p.

Activities on swamps, bogs and marshes. Written for mid-upper elementary students and illustrated with fine line drawings. Includes packets of worksheets and task cards. Two succeeding volumes with the same title cover junior high and high school students.

Quinlan, Susan E. Alaska Wildlife Week: Water, Wetlands, and Wildlife. Alaska Department of Fish and Game, 1300 College Road, Fairbanks, AK 99701. 1984. 62 p.

Excellent activities, wildlife cards, worksheets, resources, teaching guide and filmstrip; for K-12 students.

Quinlan, Susan E. and Lori Quakenbush. Alaska's Birds, Their Identification, Biology and Conservation: A Guide for Youth Groups. Nongame Wildlife Program, Alaska Department of Fish and Game and Cooperative Extension Service, University of Alaska, 1982. 81 p.

Excellent discussion of bird characteristics, bird groups, watching birds, how to attract them, and migration. Many educational activities are suggested in connection with these topics .

Russell, Barbara. Waterbirds. ORCA (Ocean Related Curriculum Activities), Pacific Science Center/Sea Grant Marine Education Project, 200 Second Avenue North, Seattle, Wash., 1980. 147 p.

Activities on migration, camouflage, adaptation, bird watching--with plans for a field trip and a game. Student worksheets and answers are included.

Vick, Paul, Kathy Christman, Dagny Evans and Randi Marks. Waterfowl Slide Kit. Indian Education Act Program, Fairbanks North Star Borough School District, P .O. Box 1250, Fairbanks, AK 99707.

A collection of materials including a slide show and script on waterfowl common to interior Alaska. Includes information on Native uses of birds.

Wehle, Duff H.S. Seabirds of Alaska Teaching Guide. Alaska Sea Grant College Program, 590 University Ave. Suite 102, Fairbanks, AK 99709-1046, 1980. 8 pp.